UTM'S CHEMICAL ENGINEERING PILOT PLANT: A PERSPECTIVE

R. A. Aziz, M. Z. Kamsah, A. Ripin, K. A. Ibrahim
Design Office of Chemical Engineering Pilot Plant
Universiti Teknologi Malaysia
Jalan Semarak
54100 Kuala Lumpur

1.0 INTRODUCTION

Chemical industries have shown an impressive growth in Malaysia in the last few years and it is foreseen that the demand for chemical engineers will increase in the next five to ten years. Realizing this, the Department of Chemical Engineering of Universiti Teknologi Malaysia will introduce more aggressive programs to ensure the production of more experienced and skilled graduates. One of the planned programs is to establish a pilot plant in this department. Currently the department has formed a team of personnels working together with an international firm to design the proposed plant.

2.0 WHAT IS PILOT PLANT ?

A Pilot Plant is a tool for investigating a process, or a process problem, on a manageable scale, and in a realistic and timely manner. It is normally operated with limited resources. Its equipment is large enough for all the important factors to be evaluated, yet small and simple enough to be as economical as possible. (see Diagram A)

In a pilot plant, an engineer studies the effects of variations in operating conditions or on diagnosing problems and determining corrective actions. A pilot plant and its products are a means to an end - the commercial facility and its products - rather that an end itself.

3.0 OBJECTIVES OF THE UTM's PILOT PLANT

Basically the aims of the pilot plant are as follows:

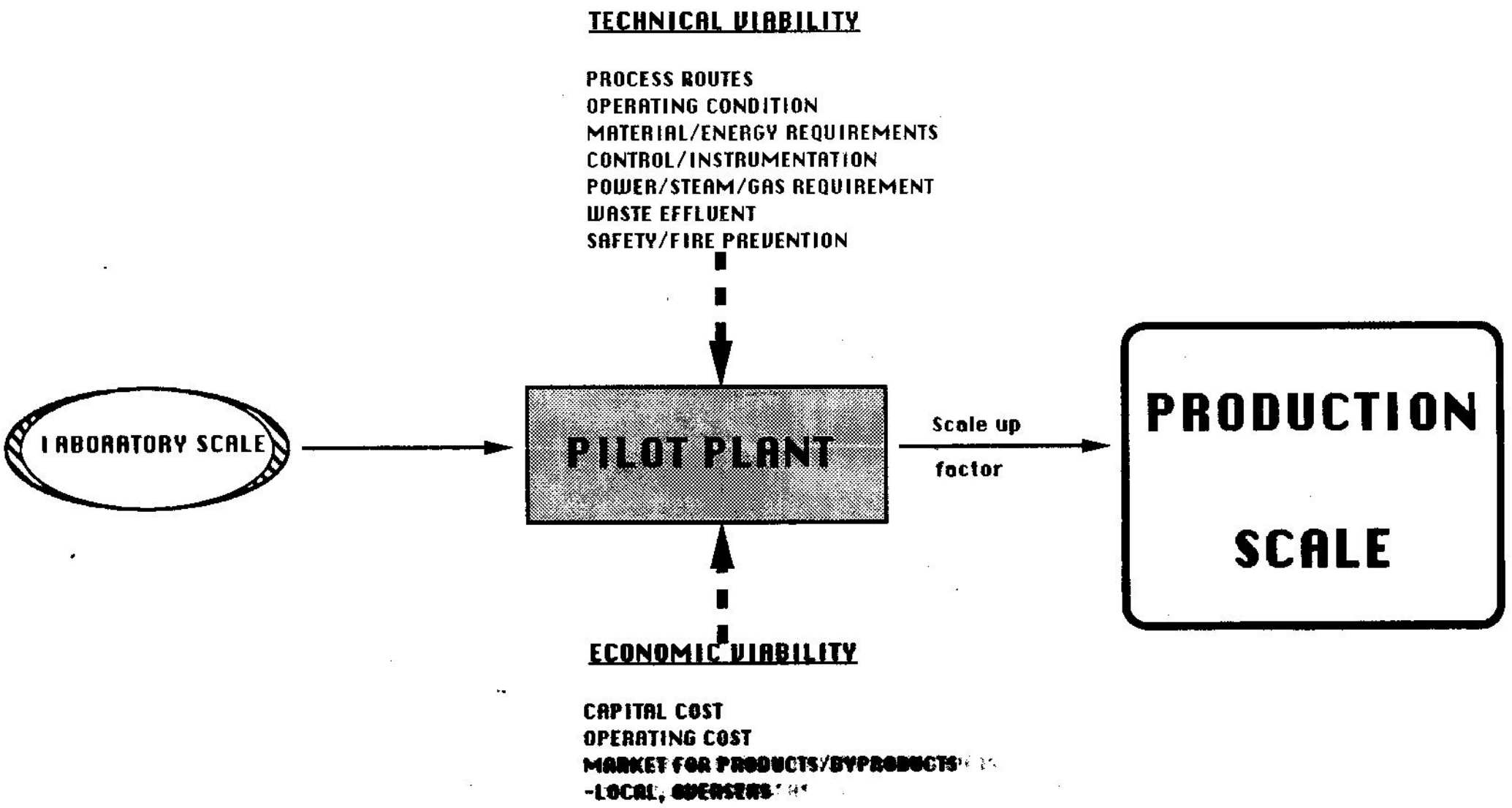
(a) To provide training for future undergraduates in plant design/construction/operation.

(b) Conduct postgraduate research and development on a pilot plant scale

(c) As a research centre to develop indigeneous and appropriate technology to process local natural resources.

(d) Act as a centre for the transfer, adaptation and assimilation of technology

DIAGRAM A - PROCESS & PRODUCT DEVELOPMENT FROM LABORATORY TO ACTUAL PRODUCTION PLANT



In accordance to the above, the pilot plant will be designed to industrial safety and operating standards.

The criteria of selection of the processes are based on the processing of local resources (palm oil, coconut oil, natural products, organic waste) and the appropriate high technology for the future development of the Malaysian chemical industry.

It is envisaged that the pilot plant will be fully operational by the end of 1994.

4.0 UTM's PILOT PLANT

Based on the above objectives, the pilot plant will consist of two main process systems and four supporting units.

4.1 Main process systems

(i) Oleo/fine chemical process system

(ii) Biochemical system

4.2 Supporting units

(i) Waste treatment unit

(ii) Quality control and assurance unit

(iii) Process control and instrumentation unit

(iv) Maintenance unit

5.0 DESCRIPTION OF THE SYSTEMS AND THE SUPPORTING UNITS

5.1 Oleo/fine chemical process system

* Major processing system for the pilot plant

* Adaptable for research and development in the processing of natural resources which could then be used as precursors for manufacturing both oleo and the fine chemicals.

5.2 Biochemical system

* The main emphasis would be to develop biologically active products derived from enough bacteria, fungi and plant cultures

5.3 Waste treatment unit

Basically, the unit would be capable of treating various types of waste generated from the operations of the pilot plant and from other laboratories. The waste type composition would include:

(a) Wastewater streams flowing in batch/continuous operations from main process systems.

(b) Solid waste such as sludges from the treatment facility itself.

(c) Solid and semi-solid wate in the form of spent contaminated media, disposables and cultures from both the bioprocess system and biochemical operations.

(d) Solid waste, highly visous organic wate (spent oil, lubricating fluid) contaminated hazardous and toxic media and cultures.

(e) Waste stream from Environmental Pollution Control laboratories containing high concentrations of heavy metal pollutants, organic hydrocarbon, pesticide, etc.

5.4 Quality Control and Assurance Unit

The products of the various operating systems (biochemical, oleo and fine chemicals) will be of suitable quality standards and this unit will provide the necessary analytical tools.

5.5 Process Control and Instrumentation Unit

The unit will be involved in maintaining the temperature, pressure, level and flow within predetermined limits of the chosen conditions of all the processes mentioned above. The instruments will be computer-compatible. The system will design the control strategies for optimizing the operating conditions and will be able to deal with an emergency or hazards operations of the process.

The process control system will be capable of controlling all the processes (oleo/fine chemical, biochemical and waste treatment processes) via a mini or supermicro computer.

5.6 Maintenance Unit

The functions of the maintenance unit include:

(a) To ensure smooth running of the pilot plant

(b) Provide fabrication facilities and assist in modification work

(c) To stock up consumables, spare parts and accessories

(d) Provide training for the pilot plant personnels related to maintenance

6.0 PRODUCTS FROM THE PILOT PLANT

UTM's Pilot Plant is designed to have the capability to produce **at least** the following products:-

Fine Chemical Pilot Plant

Fatty acids Glycerol
Fatty Amides
Subsitituted Amides
Fatty Acid Nitriles
Primary Amines
Secondary Amines
Tertiary Amines
Quarternary Ammonium Salts
Amphoterics
Amine Oxides
Essential Oils
Polyoxethylene Esters
Fatty Alcohols
Sulfated Fatty Alcohols
Methyl Esters
Partial Glycerides
Glycosides
Polyolesters
Hydrogenated Fats + Fatty Acids
Palm Olein + Stearine
Fatty Acid Fractions

Biochemical Pilot Plant

1. **Special Biochemicals/Industrial Biochemicals**

   Enzymes, Lipase, Amylases, Proteases, Glucose Isomerase, Amino acid, Polycarbohydrates, Metal leaching

2. **Food and beverages**

   Starter cultures, Sweeteners, Thickeners, Flavour enhancers

3. **Agriculture**

   Pesticides, Herbicides, Fungicides, Fertilizers

4. **Human and animal health care**

   Antibiotics, Vaccines, Hormones, Special drugs

7.0 PILOT PLANT : TOWARDS BETTER UNIVERSITY-INDUSTRY COLLABORATION

It is hoped that the existence of the pilot plant will bring university-industry together through :

*** Joint collaboration**

In collaboration work, the university and industry will share their expertise, personnels and fund to develop new products as well new testing techniques for the products

*** Contract research**

Whereby the industry engaged personnels from the university who already have experience in certain areas to carry out research of their interests. Obviously the research is entirely dependent on the budget program of the industry.

*** Leasing of the pilot plant**

Due to secrecy, it is possible for the university to lease the pilot plant to industries. The operations of this pilot plant will be entirely handled by personnels from the industry.

*** Training and Technology Transfer**

The university will provide training on the transfer of process design techniques, innovative technology and experience to the industry.

8.0 TOWARDS GREATER TECHNOLOGICAL INDEPENDENCE

One clear advantage in investing in this pilot plant is the move towards technological indepence by Malaysia in the long run. It is said that nearly all technologies involve in processing local resources have been imported from overseas through licences paid. This causes the outflow of valuable local currency. It is estimated that Malaysia paid $100 million ringgit to pay licences every year and it is increasing annually.

Eventhough the processing plants have managed to be built in the country, most of the important aspects have been designed overseas. We just received a black box in which the content is not known. We are only required to operate or maintain it.

By having a pilot plant, researchers will be able to carry out process engineering investigation on a larger scale, and to obtain product for investigations in quantities beyond the typical laboratory scale. Whatever processes or product develop can then be patented and scale - up factor can then be determined for which can be a basis to design actual production scale plant.

9.0 CONCLUSION

It is hoped that the pilot plant will play strategic roles in the Malaysian industrial and technological development in the next decade by:

* providing skilled and experienced graduates to industries
* establishing good University-Industry collaboration so that the exchange of information between the university and industry is enhanced
* providing adequate technology transfer to industries thus reducing total dependence on developed countries for the assimilation of new technologies

REFERENCES

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APPENDIX : Strategic Challenges Identified by Industrial Technology Development - A National Plan of Action

THE NATIONAL INDUSTRIAL TECHNOLOGY DEVELOPMENT ACTION PLAN has identified five "strategic challenges" faced by the country:

1. TO improve a poor science and technology (S & T) structure;

2. TO overcome a low level of technology application, and inadequate appreciation of the key role of technology in industry;

3. TO heighten awareness and focus on the critical generic technologies of the future - by building competence for specialisation in the key emerging technologies;

4. TO develop the human resource base of the required quantity and quality to support industrial technology;

5. TO provide leadership to a society that is generally apathetic and indifferent to science and technolgy development - by elevating S & T awareness and appreciation to provide the most conducive climate possible for invention, innovation and technological advancement.